FINAL REPORT

ALTERNATIVE CIVIL DEFENSE PROGRAMS AND POSTURES

William M. Brown

HI-361-RR/1 June 11, 1964

38 p [redacted]

Prepared Under Contract No. OCD-OS-63-122, Task No. 4113D
Office of Civil Defense, Department of the Army

OCD REVIEW NOTICE

This report has been reviewed in the Office of Civil Defense and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Office of Civil Defense.

A limited number of copies of this report is available to qualified requestors from Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314.

HUDSON INSTITUTE, INC.
Quaker Ridge Road
Harmon-on-Hudson
New York

TABLE OF CONTENTS

	Page
SUMMARY AND CONCLUSIONS	ii
ACKNOWLEDGMENTS	iii
INTRODUCTION	iv
I. ALTERNATIVE CIVIL DEFENSE PROGRAMS	1
The Minimum Program	1
The Inexpensive Programs	3
The Moderate Program	5
The Extensive Program	6
The Elaborate Program	7
Evaluation	8
II. PERFORMANCE OF CIVIL DEFENSE POSTURES UNDER COUNTERVALUE ATTACKS	10
Introduction	10
Alternative Civil Defense Postures	10
Enemy Targeting	14
Results	15
REFERENCES	30

CHARTS AND TABLES

Chart I	Alternative Five-Year Nonmilitary Defense Programs	2
Chart II	Performance Estimates of Civil Defense Programs	9
Table 1	Alternative Civil Defense Postures Evaluated in S.A.F.E. War Games	11
Table 2	Results of War Game Calculations for Seven Civil Defense Postures	17-29

SUMMARY AND CONCLUSIONS

The report begins by presenting a spectrum of possible CD programs, ranging from a Minimum (approximately the current survey shelter program) based on a $200 million budget to a Maximum sustained national effort, limited only by available resources. The major components of each program are listed with estimated budget requirements.

To place these alternatives in perspective some aspects of future contexts within which they might appear desirable are described in Part I. The discussion includes consideration of (1) threats of possible future worlds, (2) national goals, (3) central war strategies, (4) estimates of the likelihood of general war, (5) arms control considerations, (6) effectiveness and economic cost, (7) escalation dominance and possible nuclear war tactics, (8) domestic political considerations, (9) risks and utility of special crisis efforts, (10) phasing problems, and (11) recovery and long-range recuperation.

The purpose of the descriptions is to provide a "bird's-eye" perspective of some possible choices both present and future and their interaction with some of the other major considerations of national policy. It is a typical "stretching the imagination" approach, intended to provide insight into the relationship of the current government programs with subsequent possible developments.

The performance of the alternatives is presented in an evaluation chart which estimates their survival, political, recovery and recuperation aspects in four hypothetical wars ranging from a small Nth country attack to a large combined military-population attack of 10,000 MT.

The second part of the paper selects seven specific postures based upon the program alternatives and describes them in terms of the fallout and blast protection achieved prior to an attack. Results of fatality calculations are then presented for 13 attacks resulting from war games evaluated through the RAND Corporation's S.A.F.E. game, with some modification of the original civil defense effectiveness computations. The 13 wars fought in these games were generally in a context which involved a period of strategic warning thus enabling some preattack improvement of the civil defense posture from its normal configuration. In each of the wars some of the enemy's strategic forces eventually were allocated to a countervalue attack which ranged from a few hundred to several thousand megatons. The enemy's ability to optimize the effectiveness of his attacks varied according to the details of the war; in some cases they were far from optimal.

The two main conclusions drawn from these calculations are (1) that in some population attacks the emergency improvements in CD capability within the low budget programs have a potential for preserving the nation as an entity and/or most of its urban population; and (2) that the larger programs, based upon blast shelters in or near the urban areas, when properly designed offer a much greater potential for survival of malevolent attacks than has been generally realized heretofore.

ACKNOWLEDGMENTS

The programs and postures discussed in this paper have been evolving in our research for the last three years and, as such, have been contributed to by many people both in and outside the Institute. Thus it is difficult to place brickbats or bouquets appropriately.

At Hudson, Herman Kahn's ideas and criticisms are inevitably a strong influence. Assistance has been given by Dr. Frederick Rockett, Robert Krupka, and Max Singer by their discussion and their convictions about the potential of civil defense. At the O.C.D. John Devaney and Jerry Strope have provided continual encouragement, support, criticism, and the necessary freedom to pursue the elusive aspects of this research, whose payoff, if any, might be a decade or more away. Thanks are also due to Lloyd Woodward for a careful reading and criticism of the preliminary draft.

INTRODUCTION

This paper attempts to place civil defense into a framework that will permit useful judgments to be made about the desirability of possible future programs. It applies a typical "stretching the imagination" approach. Thus, we examine what might be about the least program of general interest at one end of the range, and at the other end, the largest program which conceivably could prove to be desirable in some dangerous future context. Then a few intermediate points of this range are defined, hoping to cover the spectrum by illustrating the major interesting variations. Thus, at the "lower" end we define a "Minimum" Program, which roughly is that existing in the country today, and at the other end, what is termed "Elaborate Underground Installations"--a description of a program representing a maximum national effort, limited only by GNP considerations or available technical resources.

A discussion of this spectrum of CD programs necessarily involves strategic, political, technical, and social feasibility questions; these will be treated briefly. Future choices would also be strongly affected by the course of international developments and the ease with which different programs can be phased into each other as requirements change. By examining the options in hypothetical contexts which make them more or less desirable, an analyst should develop a new perspective for understanding civil defense and related areas.

It is understandable that people with daily operating responsibilities within the civil defense establishment often tend to think of civil defense as being synonymous with the current government program and, possibly, with the next proposed program "in the works," that is, ready for presentation to the Bureau of the Budget or to a Congressional Committee. Thus, currently, they might be concerned mainly with what we will later term the Minimum Program, and to some extent with our next higher level, the "Inexpensive" Program. Generally, however, operating personnel are psychologically somewhat distant from the other possible future programs which attempt to visualize a changed set of values in a changed world. This paper tries to help bridge that gap by determining the potential utility of a larger range of alternatives.

Also, there is a natural tendency for the <u>tactics</u> of civil defense to be understood in terms of current plans, thereby ignoring some possible future developments which could prove to be exceedingly valuable to the development of effective protection. Newer tactics, for example, include the use of evacuation, improvised shelters, overcrowding, and/or the development of a "graded" blast shelter program (perhaps with partial urban dispersal). The structuring of a civil defense program in which several local options exist for the use of different tactics (depending on the perceived context) is a developing aspect of the nature of emergency planning which should be receiving increasing attention in the future. Some of these options are explicitly included among the alternatives presented; others are implicit by reference to reports that discuss them in more detail.

The planning of appropriate tactics depends upon a proper understanding of the range of future contexts in which they could be useful. Thus, the degree to which a program should expect to respond to long or short warning times, whether it should primarily be fallout or blast oriented, whether it should have options for partial evacuation, or which options should be centrally or locally controlled are matters for future determination in accordance with local capabilities, existing preparations, and the estimated local threat. During an emergency the public would most likely and quite properly look to the federal government for guidance in these matters. The details of local design are not explicitly dealt with in this paper, which is at a higher level of aggregation, but are to be understood as being vital parts of any chosen system.

The first part of this paper tries to extend the reader's awareness of the choices of programs and tactics and the contexts in which they might appear to be suitable. The second part assumes that these programs might have been implemented in one or more ways prior to the outbreak of a nuclear attack and calculates the expected number of fatalities as one test of the postures' utility. Thirteen different wars, each with a countervalue phase, are used to describe a set of conflicts, ranging from a few hundred to over 14,000 MT, directed against population centers. If there are any surprises in the results, they are, first, that the emergency options, if effectively implemented, might in some cases literally be capable of saving the nation as an entity and often the majority of the urban population; and secondly, that the expensive postures were found to have considerably greater potential for protection than had been anticipated, even in the larger attacks.

I. ALTERNATIVE CIVIL DEFENSE PROGRAMS

To begin, we would like to introduce six civil defense programs, defined by the accompanying chart and representing five very different levels of expenditure. Each program offers a choice which is likely to be judged to be quite different from each of the others with respect to such variables as the relationship to central war strategies, the estimated likelihood of nuclear war, the estimated spectrum of international developments, the desire for arms control arrangements, and the capability for insuring survival and recovery from possible nuclear attacks. Each estimated budget is allocated to the major elements of a balanced program, which include recovery as well as survival measures.

While many other intermediate points on the range of possibilities could be readily selected for examination, the discussion here is intended to assist the understanding of future possible choices by examining a few logical positions, qualitatively different, and well separated along a budgetary dimension. Naturally the discussion assumes that the choice of any of the programs implies a serious attitude by the federal government toward civil defense as a logical part of an integrated national strategic defense posture.

A discussion of each alternative is given below.

The Minimum Program

This first program is mainly based upon a continuing federal survey to find naturally existing shelters in the country, but is expanded somewhat to increase its operating effectiveness, and is provided with some funds for the creation of detailed plans to improve rapidly the CD posture during severe crises by mobilizing and directing a massive civilian effort in accordance with the perceived need at the time. The program could be deemed suitable for a Finite Deterrence policy, but lacks the quality of protection needed for more aggressive strategies (see Ref. 1), except where great reliance is placed on the crisis plans, an exceedingly risky policy. This program might be advocated for a world in which the likelihood of war was judged to be extremely small, and for which the future prospects of maintaining peaceful relationships among nuclear powers were deemed to be very good indeed. A choice of this posture implies that the gamble of maintaining only a minimum civil defense capability is worth taking. Its proponents argue that the proof of the nation's intentions of staying peaceful is reflected by this program, which readily offers its citizens as hostages to maintain a high level of effective mutual deterrence. The gamble is reflected not only in the plans for a minimum fallout shelter capability but also in the modest budget for the development of a crisis capability. The crisis capability would have to carry the major burden of providing protection should there be a sudden change in the perceived threat, or should a surprise attack occur. (For a more extended discussion, see Ref. 2, Chapters IV and V.) While this second possibility is perhaps most unlikely, the first is generally of much concern.

CHART I

ALTERNATIVE FIVE-YEAR NONMILITARY DEFENSE PROGRAMS

1. MINIMUM: $.2 Billion Per Annum

Use of Existing Survey Shelters	75%
Plans for Crises	20%
Plans for Recuperation	5%

2. INEXPENSIVE (Option A): $1 Billion Per Annum

110% Fallout Shelters (PF 100+)	80%
Plans and Some Preparations for Crises	15%
Plans and Some Preparations for Recuperation	5%

3. INEXPENSIVE (Option B): $1.2 Billion Per Annum

As Above Plus ~ 5 Million Blast Shelter Spaces Near Military Installations

4. MODERATE: $5 Billion Per Annum

Fallout Shelters in "B" Country	15%
Blast Shelters (10-200 psi) in "A" Country	65%
Crisis Preparations	10%
Recovery Preparations	10%

5. EXTENSIVE: $15 Billion Per Annum

Blast Shelters (10-1000 psi) in Extended "A" Country	50%
Recovery Preparations	45%
Crisis Preparations	5%

6. ELABORATE UNDERGROUND INSTALLATIONS: $50-100 Billion Per Annum

A maximum national effort to create ultra-hard dispersed underground living and working facilities.

Whether the risk of an unfavorable rapid change in international relations is appropriately balanced by the creation of a crisis capability is, of course, part of the over-all strategic decision. Even if it seemed easily possible to improvise an effective nation-wide protective effort in days or weeks of severe tension, the resources required to obtain this large capability would be quite great (at the time). A tremendous shock to "normal" economic life could develop and thus detract from any concurrent wartime mobilization efforts for several weeks or months. Besides, it would most likely create a CD capability with little legacy value compared to an effort planned and built during peacetime. Nevertheless, in a detente world--where the U.S. is trying to restrain the arms race and develop its security through establishing a large degree of arms control, and expects to succeed--the Minimum Program could be considered reasonable.

It should be clear that the protection existing upon completing a Minimum Program would be so small that if a crisis arose which threatened escalation into city attacks, the resolve needed to stand firm during the peak of the tension certainly would not be assisted by the knowledge of the country's vulnerability. If one imagines a crisis in which nuclear weapons were used as symbols of resolve (say, by use of tactical nuclear weapons in battle, or a high-altitude nighttime nuclear burst over St. Louis providing spectacular nation-wide fireworks and window-rattling for several hundred miles), the morale in the country could be severely jolted. Indeed, it might be argued that even if the crisis subsequently abated, the feeling of having been "naked" on a potential nuclear battlefield would, in retrospect, create doubt about the wisdom of the prior defense policy which left the population so ill prepared. One can, without much stretching of the imagination, believe that the result of such an experience could lead to a hasty demand for a crash program to prevent repetition and, indeed, political heads might roll among previous opponents of suggestions to purchase more protection.

The Inexpensive Programs

The two Inexpensive Program options require a context in which the nation has become substantially more civil defense conscious than at present. The smaller of these two (Option A) plans good fallout protection, a minimum PF (protection factor) of 100 for every citizen. The basic measures are similar to the proposed complete fallout protection program that the Office of Civil Defense has recently been trying to get started through Congress. The second version (Option B) adds to the fallout program about 5 million blast shelter spaces for citizens near military installations who might need protection from the initial effects of nuclear explosions in a counterforce attack. The CD posture obtainable from either of these options would allow the U.S. to maintain a central war strategy equivalent to the MFD (Mostly Finite Deterrence) or DI (Deterrence-plus-Insurance) positions (see Ref. 1 for a discussion of these and other strategies). If we had such a posture in a strategic parity or near parity context (which evidently is being anticipated in the near future by Mr. McNamara, among others), then, in a world threatened by an aggressive confrontation of nuclear powers, a modest form of civilian

protection such as that offered by the Inexpensive Program could easily be seen as a near minimum requirement for the conduct of international affairs.

Thus, the posture might be suitable for a world which was peaceful but could easily become threatening. Its choice would reflect an image of a world in which war would seem to be unlikely, but not the extremely unlikely possibility which would argue for the Minimum Program. One could argue that the Inexpensive Program is consistent with a vigorous policy to promote arms control and which advocated reducing the likelihood of war by creating a greater degree of cooperation among nuclear powers. Its opponents, however, might argue that these larger civil defense programs would tend to make the U.S. look more hostile and therefore would hamper the achievement of the goals of a peaceful world. Proponents could counter that there was still a substantial gamble even with this posture, since the lack of urban blast protection left the country extremely vulnerable to countervalue attacks (except, again, for the possibility of attaining some capability through crisis improvization).

An Inexpensive Program can be characterized by stating that, in the event of a large but purely counterforce attack, both people and property would generally survive (which need not be true of the Minimum Program because of poorer fallout protection). However, in a war in which many weapons strike our urban centers, both programs perform very poorly indeed. Against large countervalue attacks the country might survive as a unit in some catastrophic sense, but about half of the people might be fatalities unless a successful implementation of the crisis program occurred. The Inexpensive Program could prevent several tens of millions of fatalities in almost any large war, and would perform impressively in city-avoidance attacks. In addition, it provides a modest budget for recovery plans and preparations, which could include plans for the utilization of a warning period for the preservation of valuable supplies that could be transported to places of safety within the available time.

An added advantage of the Inexpensive Program, Option B, which builds several million blast shelter spaces, is that the experience of phasing in both fallout and blast shelters creates a better understanding of the requirements for a larger program and thereby forms a more reliable basis upon which such future programs could more or less rapidly be developed, if the need should occur. Indeed, one of the purposes of the budget for crisis preparations in the program is to develop some such mobilization capability which, in the context of a long drawn out international confrontation becoming increasingly hostile, would permit a vigorous civil defense program to be phased in.

We know from past experience that the apathy toward civil defense has helped prevent the acquisition of a capability as large as that of the Inexpensive Program. Nevertheless, this resistance could vanish, for example, as a result of some unpleasant escalations between nuclear powers, or even as a result of a vigorous drive by the President and the Secretary of Defense to balance the offensive and defensive aspects of our strategic posture.

With the Inexpensive Program installed, the aftermath of a very severe crisis, assuming it were resolved without conflict, could easily result in the subsequent adoption of a larger program that provided some blast protection for urban residents. The postcrisis complaints about the inadequacy of only fallout protection should be less strong than those for a parallel situation with a Minimum posture, but one could presume that the voting records of congressmen and previous statements by the spokesmen for the administration would be closely examined. Thus, one might argue that a responsible legislator faces the dilemma of risking unpopularity for advocating expenditures for a program that might not be needed during his time in office, and the possibility of having been guilty of shortsightedness, or worse, by refusing insurance against the possibility of nuclear calamity.

The Moderate Program

The fourth option shown in Chart I refers for the first time to a program with blast shelters for urban areas as well as fallout shelters for the rural areas. In addition, it provides funds for some preparations for recuperation from a nuclear attack. This program, termed Moderate, estimates an expenditure of $5 billion per year during the building phase, assuming it would be completed in about five years. The degree of urban blast protection that could be achieved under this program is equivalent to a vulnerability criterion of about 20,000 people (maximum number of blast fatalities from a 1-MT bomb; see Ref. 3). This would imply, for example, that in a 3000-MT (10-MT bombs) city attack, the number of blast mortalities would not exceed 30 million, about one-third of the urban population. This large an urban attack for many analysts would be considered nearly the "worst case." Thus with this program not only the country as a political entity, but nearly all of the rural population and most of the urban population is expected to survive a large mixed attack.

Civil defense postures of this type would be consonant with the central war strategies of Deterrence-plus-Insurance, Not-Incredible First Strike, or Arms Control through Defense (see Ref. 1). This last strategy would anticipate the program to be phased in with an appropriate degree of active defense and some reduction of offensive forces. The Soviet Union would be expected to respond similarly, with an emphasis on strategic defense and a de-emphasis on strategic offense.

The Moderate Program reduces greatly the large risk which the previous programs accept with respect to the vulnerability of the urban population and the economic gamble that chooses lower peacetime expenditures knowing that a crash program rapidly or frantically phased in during a future crisis would entail much greater cost and possibly much lower quality.

The Moderate Program can be suitable for more aggressive worlds in which the likelihood of war is deemed to be much greater than for the previous options. These might be the Gamma, Delta, or Epsilon Worlds described in a discussion of Alternative World Futures (see Ref. 4). The program would provide the President and the Congress a capability for "riding out a crisis" with increased resolve and less fear of the possible aftermath, either international or domestic.

advance preparations, might prove to be nearly as hazardous as the attack itself; and that the postattack physical environment can result in important and even subtle ecological consequences, which, without immediate attention, could result in great hardships for the survivors.

To obtain the proposed degree of protection would probably require several years, even under a crash basis, since there would be rather immense requirements for materials, skills, and equipment. It is believed, however, that with sufficient motivation and adequate preparation (to avoid the delays in operations such as obtaining legal rights, preparing site designs, engineering and testing, and solving the organizational problems) the program could be installed within two to three years, and perhaps less under very great urgency and if prior prototype experience had been obtained, say, through the Inexpensive Program, Option B. A large CD program of this kind most likely would be phased in with a parallel extensive active defense program, to the degree that active defense such as ABM or ASW were deemed to be technically feasible. These two kinds of defense would complement each other by providing protection for both people and property and by providing a base for subsequent recovery.

The Elaborate Program

This final program is one that could come about as a result of having experienced a central nuclear war. If one imagines that the country has survived any of several possible wars, from a small counterforce war to a large mixed attack, then it is easy to visualize that if the threat of a repetition of this experience has not been eliminated, a prudentially oriented nation could accept the option which required a maximum effort towards the construction of dispersed underground facilities, including industry, commerce, and housing. This program might then be viewed as part of a Maximum Damage-Limiting Strategy, in which no reasonable effort was spared to obtain the protection of either very deep or very hard underground facilities. The lesson of a previous war would have removed all thought of gambling on surviving another similar experience.

While clearly some social customs and institutions would have to change with this new mode of life, it is not at all clear whether any important political changes in the domestic relationships of government and people need to be anticipated. Certainly the international climate would have changed in an impressive way, possibly involving new forms, alliances, or blocs prominent in international affairs.

The thought of implementing the Elaborate Program staggers our peacetime imagination and, indeed, is presented here as the limiting case, which, by contrast, makes even the Extensive Program seem relatively prosaic. Nevertheless, it is important, we believe, in providing a perspective point; because, while unlikely, it is not an impossible development in a very hostile world. It should be pointed out, too, that after a program of this type had been in effect for a few years, the nature of war and prewar crises would probably have become changed. In these circumstances, the nature of deterrence and controlled warfare could become much different from the concepts

currently prevalent, and the possible threats from a multipolar world could be very different from those we anticipate today. One bizarre situation can be imagined in which only countries with extremely good resources for developing an underground technology and for handling problems of extreme amounts of fallout would be in a position to survive a subsequent large war--a hypothetical threat bordering on the doomsday devices which have been discussed in fiction, theater, and, indeed, in serious scientific literature.

Evaluation

Chart II offers an attempt to characterize the performance of the Minimum, Inexpensive, Moderate, and Extensive Programs in a number of different kinds of wars. The chart presents the estimate of the number of fatalities that might occur in the indicated wars. They represent illustrative results of the calculations from war games as presented in Part II of this paper. They do not represent an actual calculation but are consistent with those that have been made. The estimates are based upon the described programs without use of any crisis capabilities that could affect the number of fatalities significantly, especially in the Minimum and Inexpensive Programs. This will be illustrated in the subsequent section.

The last three columns present intuitive guesses about the magnitude of political and economic postattack problem areas which may be strongly dependent upon the preattack preparations. These are: (1) the (hindsight) domestic political response to the state of preattack CD preparation, (2) the time required to organize effectively for recovery operations, and (3) the duration of the recuperation period. These columns are intended more to indicate the relative effectiveness of various CD postures by criteria other than cost-per-survivor-added. If the estimates in these columns are accepted, they constitute strong arguments in favor of better preparations.

CHART II

PERFORMANCE ESTIMATES OF CIVIL DEFENSE PROGRAMS

War	Assumed CD Program	Fatalities (millions) Blast	Fatalities (millions) F/O	Postwar Political Repercussion	Reorganization Period	"Complete" Recovery
5-10 MT bombs C.V. Nth Country	Min.	10	5	Very strong	Many special problems (6 mos.)	2 yrs.
	Inexp.	10	1	Strong	Many special problems (4 mos.)	2 yrs.
	Mod.	.5	0	Weak	Some problems (3 mos.)	1 yr.
	Ext.	.1	0	None	Some problems (2 mos.)	6 mos.
5000 MT C.F.	Min.	10	20	Very strong	Confused, very difficult (1 yr.)	5 yrs.
	Inexp. (Opt.B)	1	1	Strong	Difficult (6 mos.)	3 yrs.
	Mod.	0	1	Weak	Some special problems (4 mos.)	2 yrs.
	Ext.	0	1	None	Few special problems (3 mos.)	1 yr.
5000 MT C.F. + 2000 MT C.V.	Min.	90	30	---	Great confusion, possibly nonviable (5 yrs.?)	50 yrs.?
	Inexp.	90	2	Very strong	Confusions and difficulties (3 yrs.)	40 yrs.
	Mod.	20	1	Moderate	Many special problems (2 yrs.)	20 yrs.
	Ext.	5	1	Weak	Some special problems (1 yr.)	15 yrs.
5000 MT C.F. + 5000 MT C.V.	Min.	100	50	---	Chaos, nonviable (∞)	(∞)
	Inexp.	100	10	---	Chaotic, borderline viability (5 yrs.)	50 yrs.
	Mod.	50	2	Strong	Great confusion and difficulties (3 yrs.)	30 yrs.
	Ext.	10	3	Weak	Confusion and many special problems (2 yrs.)	20 yrs.

II. PERFORMANCE OF CIVIL DEFENSE POSTURES UNDER COUNTERVALUE ATTACKS

Introduction

The Institute devoted a considerable effort to studying the procurement of alternative central war offensive and defensive forces, including a number of CD postures, and evaluated them in a variety of hypothetical wars which were "fought" by gaming techniques. (In particular, Refs. 6 and 7 describe sets of 1964 and 1970 wars which were evaluated under this procedure.) The study vehicle used for the procurement and evaluation was the RAND Corporation's S.A.F.E. game, a brief description of which is contained in the above Reference 6, and which may be examined in more detail by consulting the original source (Ref. 8). These wars generally assumed only very modest civil defense postures in determining the strategy, tactics, and targeting details. The damage calculations for an unprepared population were based upon the S.A.F.E. criteria for blast and fallout mortalities, as modified by the Hudson Institute (see Ref. 9). Subsequently, with the same targeting, the damage was recalculated, assuming the existence of various civil defense postures.

Alternative Civil Defense Postures

As a contrast to the no-protection case (Posture #1), several CD postures are defined and presented in Table 1. For 13 wars the damage (fatalities) was calculated for each posture. The results are presented later in this section.

The first of these postures, which is termed Government Survey (Posture #2), corresponds to the Minimum Program defined in the previous section and assumes that the urban population is partially protected by utilization of presently existing fallout shelters with PF's (protection factors) ranging from 2.5 to 100. The distribution of protection assumes that four classes of shelter are available to urban residents, each of which is available to one-fourth of the urban population (urban total: 104 million people) and whose PF's are 2.5, 20, 40, and 100. The PF's of 100 and 40 are intended to correspond somewhat with the better criteria for the facilities found through the current survey program. Basement shelters are given PF's of 20, and, finally, for the assumed 25% of the population unable to obtain either basements or government shelters a 2.5 PF is estimated for homes without basements. We believe this represents a conservative estimate of the peacetime protection factors that would be available if the Minimum Program worked well, especially if citizens were able to improve existing capabilities by federally guided preattack activities. (However, use of crisis preparations is handled subsequently in Postures 4 and 5.) Urban attacks should be expected to severely degrade the PF's of surviving damaged structures--a serious matter for which an adjustment needs to be made but for which a useful model does not yet exist.

TABLE I

ALTERNATIVE CIVIL DEFENSE POSTURES
EVALUATED IN S.A.F.E. WAR GAMES

POSTURE			PROTECTION FACTORS
1. NO PROTECTION			2.5
2. GOVERNMENT SURVEY	URB:	25% PF	100
		25% PF	40
		25% PF	20
		25% PF	2.5
	RUR:	20% PF	40
		40% PF	20
		40% PF	2.5
3. COMPLETE FALLOUT PROTECTION		50% PF	100
		50% PF	500
4. 50% EVACUATION WITH THE MINIMUM PROGRAM	URB:	50% PF	100
		50% PF	40
	RUR:	50% PF	100
		50% PF	20
5. 80% EVACUATION WITH THE INEXPENSIVE PROGRAM (OPTION A)	URB:	100% PF	500
	RUR:	25% PF	500
		50% PF	100
		25% PF	20
6. 100% URBAN BLAST SHELTERS 10-100 PSI		100% PF	500
7. 100% URBAN BLAST SHELTERS 10-500 PSI		100% PF	500

The rural protection under this program (by definition, 90 million people are in rural areas) is assumed to be as follows:

Per Cent of Rural Residents	PF
40	2.5
40	20
20	40

The fallout protection assumed for the 90 million rural population is believed to be somewhat conservative in this posture if a few days of strategic warning occurs.

The next posture (#3) evaluated is the developed "complete fallout" program, in which it is assumed that 50% of all citizens would have PF's of 100 and the other 50% PF's of 500. This posture is to be attained after the completion of a program costing about $5 billion. Its underlying philosophy is based upon protection in counterforce wars by providing everyone good fallout protection, which is defined by the minimum PF of 100. This posture will be recognized as consistent with the Inexpensive Program (Opt. A) of the previous section. Not surprisingly, it will be observed in the subsequent calculations that this program works very well indeed in providing fallout protection (i.e., few people are victims of radiation); but for wars in which urban centers are targeted, it offers no protection against blast or thermal effects. Also, urban PF's are (optimistically) assumed to prevail in blast damaged structures.

The next posture (#4) in Table 1 is the 50% Evacuation. The urban fallout shelters now have the higher PF's of 100 (50%) and 40 (50%) because the smaller number of citizens remaining in urban areas are assumed to occupy the better shelters. This posture derives from the crisis option of the Minimum Program of the previous section. Because a strategic warning period and some ability to respond to it are assumed, an urban evacuation is ordered, which is only partially successful. As a result of the movement the cities are half occupied. For convenience in calculation it was assumed that in each of the urban areas 50% of the population goes to rural reception areas (generally the small towns of the non-urban areas). This option plans for evacuees to construct expedient fallout shelters, mostly through the improvement of existing basements or other available natural shelter (see Ref. 2, Chapter 5). It was assumed that the final distribution of protection of the indigenous population and the evacuees would be represented by 50% obtaining PF's of 100 and 50% PF's of 20.

The implication of the assumed PF's is that the program did not work as well as was intended in two respects. First, the number of people who left the cities was less than that planned (an original goal of, say, 80 or 90%); and secondly, because of misunderstandings, lack of proper education, communication, and training, roughly half the people occupied basements without taking any meaningful steps to improve them against subsequent fallout threat. This posture, which could be considered a failure

or success depending on the context, will be observed in the subsequent calculations to perform much better than the complete fallout shelter program against many city attacks, despite the relatively poor implementation assumed.

The 5th posture, termed "80% Evacuation," also represents the use of a crisis CD option during an extreme period of tension assumed to precede the outbreak of nuclear war. This crisis may be assumed to occur after an Inexpensive Program for obtaining a "complete fallout shelter" posture was completed. This Inexpensive Program provided $50 million annually for the crisis preparations and created a basis to improvise an urban defense capability rapidly, should it ever be deemed desirable. The posture achieved assumes that the experience of developing a larger federal fallout program together with the increased expenditures for the crisis efforts (about 5 times that of the Minimum Program) resulted in an 80% evacuation of urban areas. The remaining urban citizens occupy the better fallout shelters (PF 500), while those evacuated are assumed to build or, perhaps by some overcrowding of existing space (Ref. 5), achieve higher quality shelter than in the previous posture. The protection assumed for the evacuated population is a PF of 500 for 25%, a PF of 100 for 50%, and a PF of 20 for 25%. This last group represents the portion of the program which functions most poorly, although it represents a smaller amount of ineffectiveness or confusion than previously, as a result of better plans and preparations. (In the damage calculations the fallout mortalities are often largely confined to just those people who end up with the smaller PF's.)

It is important to note that Postures 4 and 5, in practice, need not entirely rely upon a formal evacuation. Other emergency options are available in which people in the fringes of some urban areas might attempt to improvise low-level blast protection (5-30 psi) or good fallout protection through the use of trenches or of shelters hastily built with local available materials. Other local options might utilize available ships, tunnels, mines, etc. Thus, crisis programs might generally be oriented to the needs and resources of local communities. It is mainly for convenience of description that we simplisticly term them "80% Evacuation" or "50% Evacuation." More accurately, these terms are meant to indicate the fraction of the urban population able to protect itself from the blast effects of the urban attack and subsequently attain the fallout protection indicated in Table 1.

The final two postures considered (6 and 7) correspond, respectively, to the Moderate and Extensive Programs of the previous section. These are urban blast shelter programs combined with good fallout protection in nonurban areas. Posture 6 is assumed to be based upon a completed national system with blast shelters (up to 100 psi) that are built and distributed to optimize protection in accordance with the design criteria indicated in Reference 3. In addition to the blast protection it is assumed that each shelter provides a PF of 500 against residual radiation. Similarly, Posture 7 is assumed to have built even harder shelters (up to 500 psi) and to have provided a PF of 500 against radiation.

By design, these two postures offer blast protection which is equivalent to vulnerability criteria of 20,000 and 5,000 respectively. (A vulnerability criterion of 5,000 means that a bomb bursting on any urban area will kill no more than 5,000 x $W^{2/3}$ people, where W is the MT yield of the weapon.) The subsequent charts (at the end of this section) giving the fatalities from different attacks upon various CD postures state the MT-equivalent of the countervalue phase of the attack. (The MT-equivalent is found by taking the sum of all the $W^{2/3}$ for each of the enemy weapons. This sum gives a better estimate of the relative blast effects of the various attacks, especially against postures with urban blast shelters. Thus a 64-MT weapon has 16 MT-equivalent.)

Reference 3 discusses in some detail the design and cost of blast shelter systems which are oriented around a chosen vulnerability criterion and provides a rapid method for calculating the maximum number of blast fatalities to be expected from an attack against the sheltered population. It is assumed in Postures 6 and 7 that the special problem areas (such as New York City) have not only installed the requisite number and quality of shelters but, where necessary, have also managed a partial dispersal to prepared suburban shelters in order to obtain a final distribution of sheltered population consistent with the chosen vulnerability criteria.

Enemy Targeting

The wars and postures evaluated tried to simulate conditions which might not unreasonably exist or develop in actual nuclear conflicts; it was not surprising, therefore, to find that the attacks in the final countervalue phase were often less than optimal. That is, the weapons that were allocated to various countervalue targets did not maximize the damage which otherwise could have been obtained with perfect flexibility in the assignment of residual weapons. As a consequence it will be noticed in some cases that wars with larger countervalue megatonnage actually resulted in fewer fatalities and sometimes attacks with greater groundburst megatonnage resulted in fewer fallout mortalities (since the fallout threat is also related to the distribution of ground zeros).

It could be argued in some of these wars that with knowledge of the civil defense posture, even with the restrictions caused by the requirements of pursuing the war, some retargeting would have been possible to increase the damage. Although no retargeting was actually carried out, from an examination of the results it appears that the changes in damage from such retargeting in most (but not all) cases would not be very consequential (in the sense that 42 million fatalities is not significantly different from 49 million).

The results clearly indicate that for Postures 2 and 3 the main source of damage in C.V. attacks (as expected) is the blast effects upon the cities. Against the evacuation postures, in some cases, the enemy conceivably could have targeted the reception areas. This would have required both a sophisticated and malevolent doctrine and might have involved a reduction of the attack against the smaller cities. It is not clear from the S.A.F.E. model

in which wars greater damage would have been achieved by allocating some weapons to reception areas, except that in the larger attacks this generally could have been done with "profit" if fatalities were the clear objective. In Postures 6 and 7, however, since the blast fatalities per weapon are restricted by the vulnerability criterion for the system and the radiation damage is usually negligible in comparison, retargeting would not materially have changed the results. By design, the fatalities within these postures are insensitive to the details of the attack pattern.

Results

Table 2 which follows gives the results of computations of fatalities from a number of attacks, using the seven CD postures indicated above The delivered megatonnage against the U.S. urban areas ranges from 480 MT to 14,000 MT. In each the blast effects are computed first (using the S.A.F.E. criteria) and then the fallout mortalities among the survivors, to prevent overlapping of the two damage mechanisms. (The order of the computation does not, of course, affect the final totals.) The model assumes that the urban fallout shelters provide no more protection against blast than ordinary existing structures. An adjustment was made in the computation of blast mortalities to allow for the lethal effects of fire (see Ref. 9). This correction, while somewhat crude and probably understated, nevertheless is in the right direction and attempts to give quantitative recognition to fire as an important hazard in a nuclear attack. The correction, however, was not applied to the blast shelter programs, which are assumed to provide good fire protection.

While it cannot be said that the results of the calculations are surprising, in many cases they are certainly interesting. For example, it might have been expected, even if it was not clear before making the computations, that the 80% Evacuation (Posture 5) would yield results comparable to that from the Moderate Blast Shelter Program (Posture 6) in many attacks, and sometimes better. (This is because in the model none of the evacuees are subject to the blast threat.) However, it will be observed that even for Posture 4, 50% Evacuation, blast damage results are occasionally nearly comparable to those from Posture 6 of the Moderate Program. (Some analysts have argued that in an intense crisis somewhere between 20% and 50% evacuation could occur on a voluntary basis, if it were not part of an organized program.) With one exception, the fatalities for Posture 4 were lower than those for Posture 3, the complete fallout program, and in many cases they were very substantially better.

Perhaps particular attention should be paid to results related to Posture 7, which seems to provide an astonishing degree of protection and which is far from the limit of blast protection that is theoretically attainable and which might be possible to attain at less than half the nominal cost suggested for the Extensive Program in Chart I (see Ref. 3 for a more detailed discussion).

The illustrative wars all have a countervalue phase. The blast and fire casualties during counterforce attacks (in which some pains are taken in the targeting to prevent collateral civilian fatalities) can be kept

close to zero, either by use of emergency movement of civilians away from military targets or by the use of a "graded" blast shelter program in these areas as part of Postures 3, 5, 6, or 7 (see Ref. 10 for more detail on design of blast shelter programs for reducing collateral damage).

We remind the reader that a description of the force postures and the way in which the wars themselves were fought for the results given below are offered in separately bound classified documents (see Refs. 6 and 7).

TABLE 2

RESULTS OF WAR GAME CALCULATIONS
FOR SEVEN CIVIL DEFENSE POSTURES

1970 WAR #111

258 MT AIRBURST COUNTERFORCE

225 MT AIRBURST COUNTERVALUE
750 MT GROUNDBURST COUNTERVALUE (360 MT-EQUIVALENT)*

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	51	28	79	115
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	51	12	63	131
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	51	0	51	143
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	26	2	28	166
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	10	1	11	183
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	7	0	7	187
	B. 10-500 PSI	100% PF 500	1.8	0	1.8	192

*MT-Equivalent is described on page 14.

TABLE 2 (Cont'd.)

1970 WAR #1

900 MT AIRBURST COUNTERFORCE

1,776 MT GROUNDBURST COUNTERVALUE (650 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	52	46	98	96
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	52	20	72	122
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	52	1	53	141
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	26	8	34	160
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	10	5	15	179
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	13	0	13	181
	B. 10-500 PSI	100% PF 500	3.3	0	3.3	191

TABLE 2 (Cont'd.)

1970 WAR #IV

200 MT AIRBURST COUNTERFORCE
12,800 MT GROUNDBURST COUNTERFORCE

3,050 MT GROUNDBURST COUNTERVALUE (1,100 MT--EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	83	80	163	31
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	83	55	138	56
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	83	5	88	106
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	41	20	61	133
V.	80% EVAC.	URB:100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	17	15	32	162
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	22	1	23	171
	B. 10-500 PSI	100% PF 500	5.5	1.5	7	187

TABLE 2 (Cont'd.)

1970 WAR

MFD-U.S.S.R. vs. STANDARD U.S. 480 MT AIRBURST
AFTER U.S. MISSILE 1st STRIKE OF ATTACK (225 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	53	0	53	141
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	53	0	53	141
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	53	0	53	141
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	26	0	26	168
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	11	0	11	183
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	5.5	0	5.5	189
	B. 10-500 PSI	100% PF 500	1.1	0	1.1	193

TABLE 2 (Cont'd.)

1964 S.U. RETALIATION--600 BOMB ATTACK, 500 MT GROUNDBURST
(430 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	48	16	64	130
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	48	5	53	141
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	48	0	48	146
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	24	.3	24.3	170
V.	80% EVAC.	URB:100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	9	.1	9.1	186
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	8	0	8	186
	B. 10-500 PSI	100% PF 500	1.6	0	1.6	192

TABLE 2 (Cont'd.)

1970 WAR--876 MT AIRBURST (550 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	73	0	73	121
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	73	0	73	121
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	73	0	73	121
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	36	0	36	158 -
V.	80% EVAC.	URB:100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	15	0	15	179
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	14	0	14	180
	B. 10-500 PSI	100% PF 500	3	0	3	191

TABLE 2 (Cont'd.)

1970 WAR

45 BOMBERS & 140 WARHEADS — 1,792 MT GROUNDBURST (450 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	38	56	95	99
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	38	23	61	133
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	38	.1	38.1	156
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	19	7	26	168
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	8	4	12	182
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	9	0	9	185
	B. 10-500 PSI	100% PF 500	2	0	2	192

TABLE 2 (Cont'd.)

1970 WAR

CV DEVASTATION--2nd STRIKE — 2,040 GROUNDBURST (750 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	54	53	107	87
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	54	23	77	117
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	54	.4	54.4	140
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	27	8	35	159
V.	80% EVAC.	URB:100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	11	5	16	176
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	14	.3	14.3	180
	B. 10-500 PSI	100% PF 500	3	.3	3.3	191

TABLE 2 (Cont'd.)

1970 WAR

2,831 MT GROUNDBURST (1,490 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	89	24	113	81
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	89	12	101	93
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	89	.03	89	104
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	45	3	47	147
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	18	2	20	174
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	26	0	26	168
	B. 10-500 PSI	100% PF 500	6	0	6	188

TABLE 2 (Cont'd.)

1970 WAR

S.U. RETALIATION
EXTRAPOLATED U.S. vs. II-A S.U.
(COUNTERVALUE)

2,852 MT GROUNDBURST
(1,020 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	58	33	91	103
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	58	17	75	119
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	58	.7	58.7	135
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	29	10	39	154
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	12	8	19	175
VI.	100% URBAN BLAST SHELTERS		18	.5	18.5	176
	A. 10-100 PSI	100% PF 500	4	.5	4.5	189
	B. 10-500 PSI	100% PF 500				

TABLE 2 (Cont'd.)

1970 WAR

U.S. STAND NO MFD
S.U. MIXED COUNTERFORCE & COUNTERVALUE RETALIATION

4,336 MT GROUNDBURST
(1,140 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	64	92	156	38
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	64	37	101	93
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	64	.1	64.1	130
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	32	8	40	154
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	13	5	18	176
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	20	0	20	174
	B. 10-500 PSI	100% PF 500	5	0	5	189

TABLE 2 (Cont'd.)

1968 WAR--9,216 MT GROUNDBURST (2,050 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	82	97	179	15
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	82	62	144	50
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	82	12	94	100
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	41	50	91	103
V.	80% EVAC.	URB:100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	16	40	56	138
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	33	5	39	155
	B. 10-500 PSI	100% PF 500	8	6	14	180

TABLE 2 (Cont'd.)

1970 WAR

U.S.S.R. COUNTERVALUE 1ST STRIKE — 14,208 MT GROUNDBURST (3,550 MT-EQUIVALENT)

	PROGRAM	PROTECTION FACTORS	MORTALITIES (MILLIONS) BLAST	F/O	TOTAL	SURV.
I.	NO PROTECTION	2.5	80	110	190	4
II.	GOV'T SURVEY	URB: 25% PF 100 25% PF 40 25% PF 20 25% PF 2.5 RUR: 20% PF 40 40% PF 20 40% PF 2.5	80	61	141	53
III.	COMPLETE FALLOUT	50% PF 100 50% PF 500	80	15	96	98
IV.	50% EVAC.	URB: 50% PF 100 50% PF 40 RUR: 50% PF 100 50% PF 20	40	67	107	87
V.	80% EVAC.	URB: 100% PF 500 RUR: 25% PF 500 50% PF 100 25% PF 20	16	45	62	132
VI.	100% URBAN BLAST SHELTERS					
	A. 10-100 PSI	100% PF 500	49	9	58	136
	B. 10-500 PSI	100% PF 500	13	11	24	170

REFERENCES

1. Kahn, Herman, editor. A Paradigm for the 1965-1975 Strategic Debate, HI-202-FR. Harmon-on-Hudson, N.Y., Hudson Institute, November 22, 1963.

2. Brown, William M. Strategic and Tactical Aspects of Civil Defense with Special Emphasis on Crisis Situations, HI-160-RR. Harmon-on-Hudson, N.Y., Hudson Institute, January 7, 1963.

3. Brown, William M. The Design and Performance of "Optimum" Blast Shelter Programs, HI-361-RR/2. Harmon-on-Hudson, N.Y., Hudson Institute, June 11, 1964.

4. Pfaff, William and Stillman, Edmund, editors. Study for Hypothetical Narratives for Use in Command and Control Systems Planning, Volume I: Profiles of the Future, HI-285-RR. Harmon-on-Hudson, N.Y., Hudson Institute, September 1963.

5. Krupka, Robert A. Overcrowding Potential, HI-361-RR/4. Harmon-on-Hudson, N.Y., Hudson Institute, June 11, 1964.

6. Rubinow, Shirley. Sample Counter Force and Counter Value Wars in 1964 (U), HI-63-181(Rev.). Harmon-on-Hudson, N.Y., Hudson Institute, March 18, 1964. (SECRET)

7. Rubinow, Shirley. Some 1970 Central Wars (U), HI-64-170 (HI-358-DP). Harmon-on-Hudson, N.Y., Hudson Institute, May 7, 1964. (SECRET)

8. Helmer, O. SAFE: A Strategy-and-Force Evaluation Game (U). Santa Monica, California, The RAND Corporation. RM-3287-PR. October 1962. (SECRET)

9. Brown, William M. Some Suggestions for Civil Defense Alterations to SAFE, HI-193-DP. Harmon-on-Hudson, N.Y., Hudson Institute, February 12, 1963.

10. Krupka, Robert A. Collateral Damage, HI-361-RR/5. Harmon-on-Hudson, N.Y., Hudson Institute, June 11, 1964.